The Astronomical Society of Edinburgh

Journal

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The Moon and Mercury on the evening of 2008-05-06. Photographed by Rachel Thomas with an f = 300 mm, f/5.6 lens and 1.6 s exposure.

28 years of ASE Journal – now online

The first issue of the *ASE Journal* appeared in August 1980, 28 years ago. All of the Journal is now available on the web, for you to read yourselves.

The Journal was founded in 1980 by Dave Gavine, who remained the editor until No 50 in 2006. The 28 years of Journal history can be divided into four eras:

1. **Nos 1 to 37 (1980 to 1997):**
   In this era the Journal was an A4 photocopy with a mix of line drawings, photographs and rasterised photographs. Initially it was typed on a single typewriter, a practice that gave way to collating manuscripts typed by authors, and in later years many manuscripts were computer-printed rather than typed. Over the years Dave was helped by Ray Fenoulhet, Neil Bone, Duncan Waldron, Brian Kelly, Iain Neil, Jim Nisbet and Graham Rule with the production of the Journal. The Royal Observatory Edinburgh (ROE) provided resources, such as photocopying.

2. **Nos 38 to 46 (1998 to 2003):**
   In this era Graham Rule took on a more important role as assistant editor. He collected all content digitally and put it to paper at the end in one consistent layout. Duplication was still by photocopier. This was the computer-age equivalent of typing everything in one go on one typewriter with consistent typing conventions. The figures were now also digital. This was a few years into the age of the world wide web, and part of the rationale for keeping it all digital was to make a web version alongside the paper version.

3. **Nos 47 to 50 (2004 to 2006):**
   In this era Dave Gavine was helped by Des Loughney with the word processing and printing. Final editing remained computer-based. While most pages continued to be grey photocopies, a welcome splash of colour photographs was added, making use of an inkjet printer. The web version was discontinued.

4. **Nos 51 onwards (2006 to present):**
   After 50 issues Dave Gavine stepped down as editor and I took on that role. The Journal is now published in two equally important versions. The web version uses a conservative and simple style, so as to produce reasonably predictable results in anyone's web browser now and in the future, and so as to obey the reader's preferences for typeface and type size. The paper version continues to be completely computerised, with the typesetting done by the LaTeX software that has been popular in scientific publishing since the early 1990s. The paper copy is no longer a photocopy, instead the computer instructs the printer to spit out so many copies of each sheet.

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ASTRONOMICAL SOCIETY OF EDINBURGH

The old "Gothic Tower" observatory and assistant astronomer's house, Calton Hill, c.1845.

Journal 3

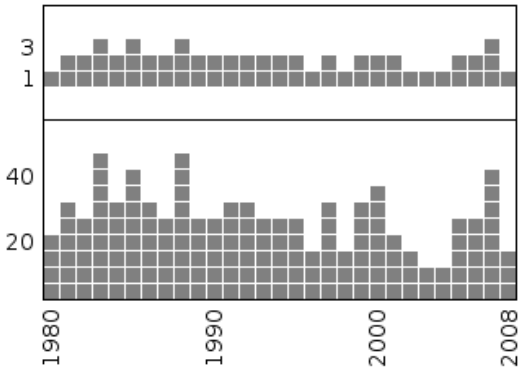
October 1981

20p.

Title page of ASE Journal 3 (1981).

What has mostly been called "recent observations" was already there in No 1. This item continues to this day, and members are encouraged to let the editor know about observations they have made. The Journal has promoted observational astronomy in other ways. From the start until 1998 there were regular reports on the activities of the meteor observers of the Northern Network. Neil Bone organised this northernmost of three regions of BAA meteor observers. Until his move to England he wrote regular reports in the *ASE Journal*. Colin Steele from St Andrews took over the Northern Network in 1986 and continued the reports until he, too, left for England in 1993. Brian Kelly – by then in Dundee – continued the reports for the Scotland / North England region until No 38 (1998).

Neil Bone also wrote on other matters in the *ASE Journal*. In No 1 he asked "Did life originate in outer space?" and with his remarks on UFOs provoked the first letter to the editor, from Steuart Campbell. Steuart has since been one of the most consistent contributors to the Journal. Other authors have promoted observation, including Gavin Ramsay, Ron Livesey, Des Loughney and John Reid. Notable is the series of entertaining observer's logs that Alastair McBeath from Morpeth sent in between 1985 and 1989. Another regular external contributor was Graham Young from Dundee, with articles that often have a solar-system theme. Duncan Waldron was a regular contributor during the 1980s and early 1990s, often supplying photographs and some articles about photography. He also sent two articles while living in Australia.



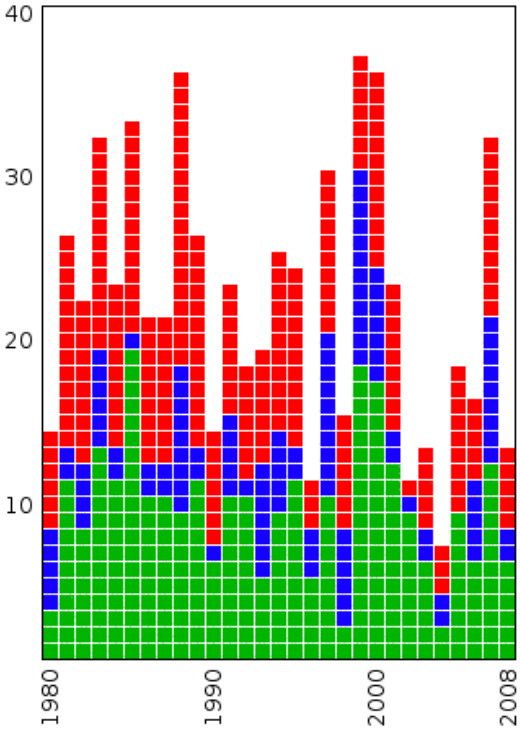
Histogram of Journal issues (top) and Journal pages (bottom) in each year.

Dave Gavine is of course the most prolific author in the *ASE Journal*, being the editor. Dave's articles tended to be about the history of astronomy in Scotland, the subject of his PhD thesis of 1981. Graham Rule is the second most frequent contributor to the Journal, often writing on history, books or publishing, with a number of contributions ex officio as current Secretary, past assistant editor, and past President.

Which brings me to the other regular item that started very early. Without fail, *Journals* **2** to **37** (1981 to 1997) had an item "society news", which listed talks past and future, who had been elected to the Council, new books in the library, publications by members, etc. After 1997 this item was replaced by "From the President", in which Graham Rule, Jim Nisbet,

Allan Ellis, Lorna McCalman, Dave King and Des Loughney during their respective reigns provided less formal information about the progress of the Society. I have re-introduced the society news in No 55, but this is intended as a complement to and not as a replacement of the articles from the President.

Soon after I became editor I filled the gap in the web version left by era #3. Nos 47 to 50 on the web use the same layout and style as the later issues. Webifying era #1 would be a more difficult project: Instead of just four there would be 37 issues to process, and none of their content could be obtained in any digital form. As I joined the Society only after that era I do not even have paper copies. For a while I had wanted to read those old Journals, but only in December last year did I discover that the ROE Library had all issues from era #1. I decided to scan all the pages into the computer and assemble text and pictures into a web version similar to the current Journal issues. I would do my reading as a side effect of checking and correcting the text recognition results. The software would make mistakes like taking an "M" for an "H" etc. On one occasion it changed an "H" into and "R", so that the text would speak of "what went wrong with the Rubble Space Telescope".



Histogram of Journal items in each year.
Green: by the 13 authors with 10 or more items.
Blue: by authors with 9 or fewer items.
Red: items without author.

On average there were two issues per year, during the first 15 years slightly more, since then less than that. Each issue was between 10 and 20 pages long; on the whole the pages per year show the same picture as the issues per year. The grand total of 55 issues is 764 pages.

The web version of *Journals* **1** to **37** is available on the Society web site, integrated with the web versions of the later issues. Simply go to [1] and use the hyper-links

you find. Nos 38 onwards are public, but for the old issues up to No 37 you need to supply a username and password. You may find the details near the back of this paper copy, or you may have received them in an email from the editor. If you have missed out on this, just contact the editor. The authors that contributed in era #1 would have written their material on the assumption that only members of the Society and few others would normally access the Journal. It would not be right to have these old Journals now available to all Internet users and to have them indexed by web search engines.

The web version of the old Journals tries to be true to the original, but it is by no means a facsimile of the original paper version. The markup has been changed slightly, the use of headlines and naming of authors is more consistent, partly to aid the creation of indices. There are indices of all contributions to the Journal from No 1 to the present. One index is chronological, one lists all items by author, and a third lists those items that have no named author. The whole Journal (Nos 1 to 55) has 764 pages and these contain 639 articles and smaller contributions. Of these 252 (40 %) have no author; for the most part these are small announcements or regular items that the editor compiled. But this figure also includes a number of title pictures for the most part by or obtained by Dave Gavine. There have been 73 authors in all, 13 of them with ten or more contributions. Of the 387 items with authors 270 (70 %) have been written by these more prolific authors.

After 28 years the Journal now changes from A4 to A5 format. I hope readers will like the result. I am forced to take this step as a combination of how Royal Mail charges for different sizes of letters and how laser printout suffers from being folded. Since cost stops us from growing the envelope to fit the Journal, we have to shrink the Journal to fit the envelope.

Acknowledgements

First of all, thanks go to all the contributors to the *ASE Journal*, they are listed at [2] and some of them have been mentioned above. Second, to Dave Gavine as editor and to his assistants, who have also been mentioned above. Third, to the Royal Observatory Edinburgh for the resources they provided and still provide. Thanks also to the ROE Librarian, Karen Moran, for letting me borrow the Journal for scanning. Finally, thanks to yourselves. For reading this, and for writing something for future Journals (hint!).

Further reading

1. *ASE Journal*,
   http://www.astronomyedinburgh.org/publications/journals/

2. *ASE Journal* author index,
   http://www.astronomyedinburgh.org/publications/journals/byauthor.html
3. *ASE Journal* content 1980 to present,
   http://www.astronomyedinburgh.org/publications/journals/bydate.html

Horst Meyerdierks

Society news

The Annual General Meeting on 2008-03-21 elected the Office Bearers and Council. This left three vacant Councillor positions which the new Council has since filled by co-option. The resulting Council is as follows:

- President: Iain McEachran
- Vice-Presidents: Daniel Gallacher and Kenneth Thomas
- Secretary: Graham Rule
- Treasurer: Alan Ellis
- Councillors: Elected: Des Loughney, Horst Meyerdierks and David Small. Co-opted: Frank Howie, Peter Mulholland and Rachel Thomas.

The AGM was followed by the Presidential Address entitled "We are star dust", in which Iain took us around the cycle of stellar evolution from star formation and planet formation from interstellar gas through synthesis of heavy elements in stars and in supernovae, and to the return of material into interstellar space via stellar winds, planetary nebulae and supernova remnants.

In his talk on 2008-03-07 Prof Andrew Collier Cameron of St Andrews University reported on the SuperWASP project. Using off-the-shelf (and on occasion off e-bay) telephoto lenses and state of the art CCD detectors, they search for brightness dips due to transits of extra-solar planets in front of their stars. They are remarkably successful with 14 new planets discovered so far, quite a few of them presented to ASE as world exclusives. On 2008-04-04 Russell Eberst spoke on satellite tracking and "other things". He is one of the amateur observers who fill in the blanks in public knowledge about secret military satellites. He mentioned a few 50th and 100th anniversaries and a number of aspects of observing objects of the solar system from the Moon and its earthshine to the sometimes vanishing rings of Saturn. Ken Kennedy from Dundee on 2008-05-02 spoke on the lunar maria. Until the mid 20th century lunar craters were thought to be volcanic, but now we know that they are impact craters. It is in fact the lower, flatter maria that resulted from liquid magma seeping

through the floors of giant impact basins, filling them only 100 to 700 million years after the impacts themselves.

At the 2008-03-10 Observing Group meeting the sky was overcast. Nonetheless two novices could be instructed in the setting up and simple use of their equatorial mount. On 2008-04-07 the weather seemed unfavourable, too, but the crescent Moon and earthshine made a surprise appearance in the end.

Renovation work continues on the Astronomer's House, leading to continued minor disruption of access to the Calton Hill Observatory by the southern door; access to the Ordinary Meetings by the eastern gate is unaffected. Significant work has also been carried out on the footpaths, including installation of new lampposts. It is to be welcomed that the City Council are carrying out these improvements on Calton Hill, and we in particular look forward to the replacement of the missing lead on the roof of the Playfair Building (the central building in the Observatory grounds). This roof repair has now been scheduled by the City Council and some scaffolding was in place in early May.

Forthcoming events

2008-06-06	20:00	*speaker TBD* **Title TBD**
2008-07-04	20:00	*speaker TBD* **Title TBD**
2008-08-01	20:00	**Members' Night** Short presentations by members of the Society
2008-09-05	20:00	Gerry Taylor, ASE **Twenty bright stars**

Our meetings are open to the public (unless otherwise stated). We are always happy to see new faces. Ordinary meetings take place at 20:00 (Civil Time) in the City Dome of the City Observatory, Calton Hill (usually on the first Friday of the month). Any changes to our meeting arrangements will be put on our website http://www.astronomyedinburgh.org

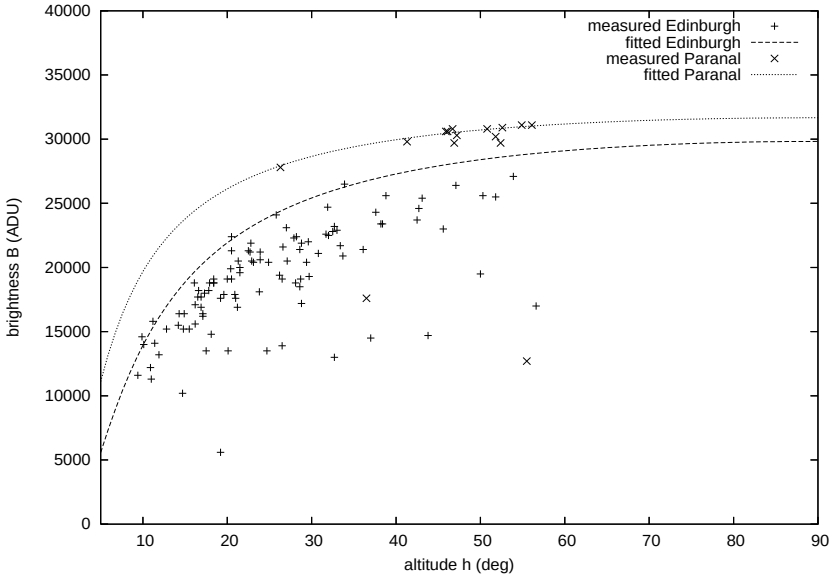


Fig. 1: *Measured brightness of the Sun plotted against its altitude. ADU (analogue-digital units) are simply the brightness values from the images. Upright crosses are for sea-level observations, diagonal crosses for 2600 m altitude. The curves are equivalent to the straight lines in Fig 3.*

Backyard astrophysics:

Atmospheric extinction

For a number of years the idea of "backyard astrophysics" has been in the back of my mind. An example of this is to stand in your backyard one clear night and ponder why it is dark at all. (It is dark because the universe is quite empty and not infinitely old.) But we can make slightly more complex observations and use these to demonstrate other astronomical knowledge.

One kind of observation I make quite frequently is to take an image of the Sun (to count sunspots and measure their positions). These images are taken in raw format and a dark frame is subtracted. This means that the image values are proportional to the surface brightness. This would not be the case if I obtained JPEG images from the camera, which would involve a non-linear contrast stretch. I take a note of how bright the centre of the solar disc is each day. I also calculate the Sun's altitude above the horizon at the time the image is taken. All images are taken with the same

camera, lens, exposure time, ISO setting etc., so that the brightness values can be directly compared day-to-day. Some of the observations are taken not from sea level, but from Cerro Paranal (Chile) at an altitude of 2600 m; these have to be considered separately. (Unfortunately, "altitude" is used both for altitude in metres above sea level and for altitude in degrees above the horizon.)

As you will have noticed yourself, the Sun is quite a bit fainter low on the horizon than when it is high in the sky. With almost a year's data my observations cover a certain range of solar altitudes, so that I can draw a diagram of measured brightness of the Sun against its altitude. This is shown by the crosses in Fig. 1. The brightness is clearly less when the Sun is low, and this is very much the case below about 25° or 20° altitude. Sadly, in winter, the Sun hardly rises to 10° altitude in Scotland. The Paranal observations lie noticably above the sea-level observations.

To make more sense of the observation we need to approach the issue from the opposite – the theoretical – end. First, the Sun does not change in brightness, what we see is due to the Earth's atmosphere. When we look straight up there is relatively little of it in our way, but when we look along the horizon there is rather more atmosphere along the path that the light takes from the Sun to our camera. The problem is that the air particles absorb and scatter the light so that only part of it makes it along the straight line to the observer. The combination of absorption (molecules taking out photons to change their own state to one of higher energy) and scatter (molecules bouncing photons into a new direction) is called *extinction*. It is not only the gas, but also dust and aerosols that cause extinction.

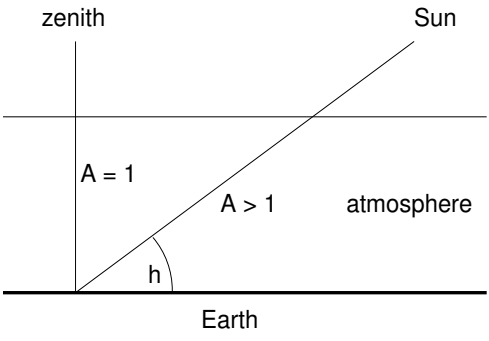


Fig. 2: *The airmass A is the relative path length though the atmosphere. At the zenith it is one by definition. At lower altitude h it is larger by a factor* $1/\sin(h)$.

Assuming a locally flat Earth with a flat layer of atmosphere on top of it (Fig. 2), the airmass – the obstacle the atmosphere presents to the light on its way from the Sun or star to the observer – is simply

$$A = 1/\sin(h)$$

But the airmass is not the whole story. As the light passes through the length measured by the airmass, the number of photons decreases not at a constant rate, but exponentially. We are familiar with the analogy from radioactivity: If a radioactive isotope has a half life of 30 years then it takes 30 years for the substance to be halved, after 60 years it has diminished to a quarter, and so on. The mathematical

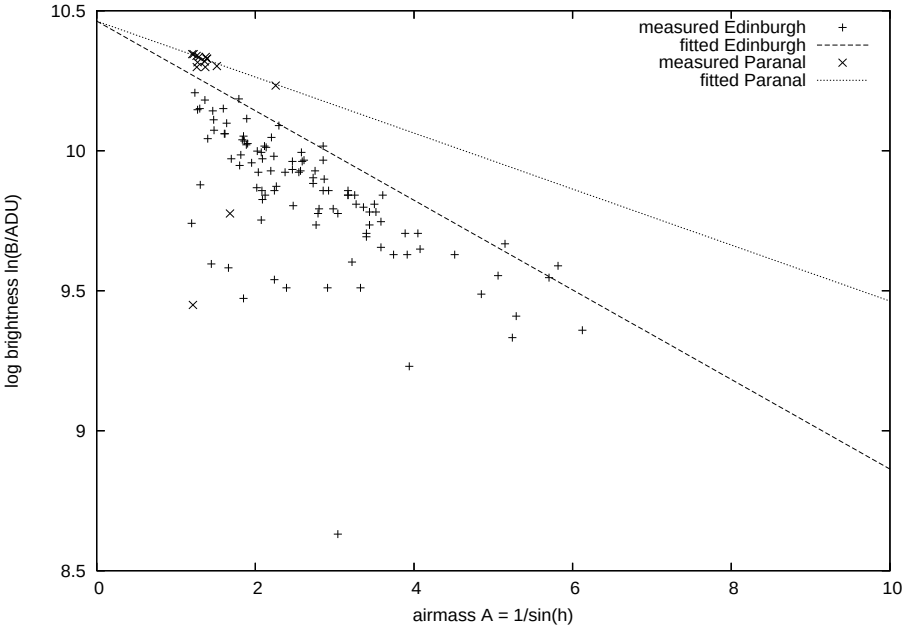


Fig. 3: *Measured brightness of the Sun plotted against airmass. The vertical scale is logarithmic. The lines are fitted "by eye" to describe the observations with highest brightness (best weather).*

tool for this sort of problem is the exponential function exp(), and for extinction in the atmosphere we can write

$$B = B_0 \exp(-kA)$$

B: brightness after passage through the atmosphere
B_0: brightness outside the atmosphere

The airmass itself is not enough to describe what happens to the light. The number k – similar to radioactive half life – indicates how much the light is weakened by an airmass of one. That's nice maths, but how does it help us? We need even more maths, I'm afraid, namely logarithms. That does not actually add to the complication, because the natural logarithm ln() is simply the inverse function of the exponential. In the equation above we can take the logarithm on each side and arrive at an equivalent – but more helpful – description:

$$\ln(B) = \ln(B_0) - k\,A$$

	Paranal	**Edinburgh**
airmass at zenith	1.00	
airmass at 60° altitude	1.15	
airmass at 30° altitude	2.00	
airmass at 15° altitude	3.86	
brightness above the atmosphere	35000 ADU	
extinction per airmass (k)	0.10	0.16
brightness at zenith ($\exp(-k)$)	90 %	85 %
brightness at 60° ($\exp(-kA)$)	89 %	82 %
brightness at 30° ($\exp(-kA)$)	82 %	71 %
brightness at 15° ($\exp(-kA)$)	68 %	52 %

Tab. 1: *Summary of results. Airmass at four different altitudes, brightness corrected for extinction. Separate for each altitude above sea level the parameter k and the fraction of light left at various altitudes above the horizon.*

This may not look more helpful, but it is. This is the description of a straight line! The line falls with a slope of k. What we have to do to make the line visible is not to plot B against altitude h (Fig. 1), but to plot $\ln(B)$ against airmass A (Fig. 3, note that altitude increases to the left in this plot).

Now you see how the data points make a straight line. The scatter in the observations is due to the weather variation from day to day. It is valid to look particularly at the high points, because those points will arise from similarly good weather. The two straight lines are "fitted by eye". We need separate lines for sea level and high altitude, but both lines must intersect at airmass zero. This is because the brightness value at airmass zero is the brightness of the Sun or star outside the atmosphere.

Tab. 1 illustrates the meaning of the lines we've drawn in Fig. 3. The corresponding curves are in Fig. 1, where they are of more practical use. Even a star at the zenith has already lost 15 % of its light, more light is lost if the star is at lower altitude above the horizon. Above 30° this is still acceptable, but for objects lower than that we should have a think whether we can observe it at another time when it is higher. This is even more the case when observing at high magnification (planets, the Moon, etc.) because the image quality will also degrade with increasing airmass. Alas, usually the answer is that we have to observe even at low altitude. We want to count sunspots in winter as well as in summer, a close Mars opposition is always at southerly declination, Mercury is never far from the Sun, the weather may not be good another time, and so on.

We can convert the extinction factor into a loss of stellar magnitude with the formula

$$\Delta m = -2.5 \lg[\exp(-kA)]$$

$\lg()$ is the decadic logarithm and not the natural logarithm $\ln()$ we used above; the difference is a factor $\ln(10) = 2.3026$. If we take an observation from Edinburgh at 90° altitude, the atmosphere dims a star by almost 0.2 mag. Compare this to the extinction caused by dust and gas in interstellar space: In the plane of the Milky Way but avoiding any dark clouds the extinction is about 0.3 mag/kpc. So in one sense at least, our few tens of kilometres of atmosphere are as thick as about 600 pc (2000 light years or 19,000,000,000,000,000 km) of interstellar space. Since space travel began we have come to think of our atmosphere as a very thin and fragile shield against what Sun and stars throw at us, and this is true. It is in mass equivalent to only 10 metres of depth into the oceans. But compared to interstellar space it is – fortunately – very massive indeed.

Horst Meyerdierks

Perseids 2008

Delighted to see SAG getting back to its roots! Might I start the ball rolling project-wise with a quick reminder of this August's Perseids? SAG has excellent previous on this shower, particularly from 1977-1983, and Scottish observers have continued to contribute really valuable results to the BAA Meteor Section into the 2000s. However, we can always use more observers!

Circumstances for the shower aren't too bad in 2008. Activity starts in late July, and during the relatively moonless first 10-12 days of August, it should be possible to get good watches in as the rates climb. Peak will be around Aug 12d 09h UT, if all runs to the pattern of recent previous years. This means that Aug 11-12 (a Monday-Tuesday) will probably be the most productive night, though 12-13 and 13-14 will also be good. The Moon is a waxing gibbous by maximum, but sets around 23h 20m local time on August 11 (later, of course, on the subsequent nights). So, on the best night, there's plenty of dark sky, especially later in the night when the radiant is climbing higher. I'd strongly encourage SAG observers to think about giving it a go this August – and, of course, let me have your results! Now's a good time to start planning observing runs. More details can be found on the BAA web-pages: http://www.britastro.org/meteor

Neil Bone
Director, BAA Meteor Section

This item was posted on 2008-04-21 to the Scottish Astronomers' Group online forum at http://sagforum.proboards79.com

Recent observations

Sun

Horst Meyerdierks takes an image of the Sun whenever possible and averages his spot counts in 30-day intervals. He reports the following R numbers (number of spots plus ten times the number of spot groups):

2008-01-05 / -02-03	3.1	2008-03-05 / -04-03	9.7
2008-02-04 / -03-04	1.5	2008-04-04 / -05-03	0.0

While numbers appeared to rise from a minimum of 1.1 in October 2007, and while March 2008 was as active as last July, April 2008 activity is again very low.

Asteroid occultation

Horst nearly observed the occultation of the 4.8 mag star 36 Com by minor planet 1886 Lowell on 2008-04-11. The previous evening was clear enough to have a test run. On the night the sky was mostly covered in cloud, but a clear patch in the right place allowed the star to be located with binoculars a few minutes before the occultation – just as well this had been practised before. For the crucial few minutes the clear patch was, however, elsewhere.

Noctilucent cloud

No noctilucent cloud has been reported to this Journal yet, but the season opened very early this year with a sighting from Northern Ireland on 2008-05-04/05 (cf. http://www.spaceweather.com).

Mercury

Mercury was visible in the evening sky in early May. 2008-05-06 was clear, and a number of observers – including Frank Howie, Rachel Thomas (see cover picture) and Horst – spotted the planet next to the crescent Moon. Frank's report is a dog's tale: On the way back from his observing spot he lost the memory card with the precious pictures (see Frank's item on page 15). To vent his frustration he took the dog for a walk. "And so it came to pass that by re-tracing my steps, assisted by the dog and her wonderful nose our combined intellects, senses and sheer dogged determination (mine too), she guided us to the very spot where the precious little card lay."

Moon and Mercury over Edinburgh

The image was taken from Craiglockhart Hill, one of the 'Seven Hills of Edinburgh'. I enjoy this genre – landscape or townscape with skyscape – a relaxing alternative to the sometimes stressful discipline of deep sky imaging, with complex equipment.

The hill is a very fine astronomy location for me as it is only a 10 minute walk from home, with unobstructed views over the city towards the Castle and beyond across the Forth to Fife. Camera and tripod don't weigh too much and the dog is a good companion on cold, dark windswept hills!

Frank Howie

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About the ASE Journal

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